

Allometric relationships of Americans, Croatians, and Bosnians. A.H. ROSS, R.L. JANTZ, Dept. of Anthropology, The University of Tennessee, Knoxville; D.W. OWSLEY, Dept. of Anthropology, Smithsonian Institution, Washington; Z. CIHLARŽ, T. VEDO, Sudsku Medicinu, Klinički Centar, Tuzla, Bosnia; M. SLAUŠ, and D. STRINOVIĆ, The University of Zagreb, Croatia.

Recent studies of secular change and allometry have observed differential limb proportionality between sexes and among populations (Meadows and Jantz 1995; Meadows Jantz 1996). However, the forces responsible for the variation in limb proportions remain unclear.

The purpose of this study is to examine the allometric relationships among contemporary American White, Croatian, and Bosnian males. The maximum Croatian sample totals 97, and the maximum Bosnian sample is 80, both a result of the recent civil war. The American White sample totals 133 and was obtained from the Forensic Data Bank. The maximum lengths of the humerus, radius, ulna, femur, tibia, and fibula were utilized.

Size and shape variables were computed according to Mosimann and colleagues (Mosimann 1979; Darroch and Mosimann 1985) using the raw measurements. ANOVA's were performed on size and shape variables. In addition, a discriminant analysis was conducted on the shape variables.

The ANOVA procedure did not yield a significant difference in size among populations. However, it did yield significant differences for the humerus, radius, femur, and fibula shape variables. The results indicate that although American Whites, Croatians, and Bosnians do not differ in size, their proportions differ considerably. Croatians and Bosnians have relatively longer humeri, while their radii and ulnae are relatively shorter than Americans. Americans and Bosnians, however, have relatively shorter femora and longer tibia and fibulae and Croatians exhibit the opposite, longer femora and shorter tibia and fibulae. Variation in limb proportions is thought to reflect climatic adaptation. Our results show that considerable proportional variation is independent of climate. These results also suggest that stature formulae may not be transferable between populations.

*In vivo* intraorbital bone strain in anthropoid primates during mastication and incision. C.F. ROSS. Anatomical Sciences, SUNY at Stony Brook, NY 11794-8081.

The haplorhine circumorbital region is distinguished by its postorbital septum, and highly convergent, frontated and approximated bony orbits. The impacts of these features on the biomechanics of the facial skeleton are unknown, partly because of a poor understanding of how the facial skeleton behaves during chewing, and partly because of a lack of *in vivo* bone strain data from many areas of the face. New *in vivo* bone strain data obtained from the intraorbital surfaces of the postorbital septum, supraorbital torus and medial orbital wall in *Macaca mulatta* and *Aotus trivirgatus* provide data to evaluate hypotheses regarding loading regimes in the anthropoid face and the functional

significance of haplorhine synapomorphies. Bone strain along the intraorbital and anterior surfaces of the working side lateral orbital wall in macaques suggest the lateral orbital wall is being dorsoventrally compressed and "buckled" in a manner similar to that hypothesized for *Aotus* (Ross and Hylander, 1996; Ross and Chen, 1997). Data from the medial orbital wall of *Macaca* and *Aotus* support hypotheses that the face is bent concave dorsally in the sagittal plane during mastication. Bone strain gradients observed in superficial aspects of the macaque facial skeleton during mastication are also seen along the medial orbital wall and postorbital septum, where strains are an order of magnitude smaller than those seen in the anterior root of the zygoma. The postorbital septum is hypothesized to have evolved to insulate the orbital contents from movements in the temporal fossa because of increased orbital frontation (Ross, 1995), invoking spatial factors similar to those hypothesized for the supraorbital torus (Ravosa, 1989). The medial orbital wall may also serve to spatially separate orbit and nasal cavity. Low strains in all these regions support the notion that their presence does not serve a biomechanical function associated with the stresses of mastication. Funded by NSF SBR-9706676.

Plant choice in the construction of night nests by mountain gorillas in Bwindi Impenetrable Forest, Uganda. J. ROTHMAN<sup>1</sup>, G. MAYOBA<sup>2</sup>, E. DIERENFELD<sup>3</sup> and E. RODRIGUEZ<sup>1</sup>, <sup>1</sup>Cornell University, Plant Biology, Ithaca, New York 14853. <sup>2</sup>Institute of Tropical Forest Conservation, P.O. Box 44, Kabale, Uganda. <sup>3</sup>Wildlife Conservation Society, Nutrition, Bronx, New York 10460.

This study was designed to investigate aspects of selectivity in plants chosen for night nests by mountain gorillas (*Gorilla gorilla beringei*) in Bwindi Impenetrable Forest, Uganda. Over a 1-month period (June 1998), 100 fresh nests (<24 h) used by a single group of gorillas (11 nest-building animals) were evaluated. The number of stems of each species in each nest was counted, and compared against density counts of all plant species within two meters of the nest site. Observations of nest habitats and overall nest characteristics were also recorded.

During the course of the study, gorillas only nested in secondary forest, although other habitat types were available. Ground nests dominated (99% of observations), nests were almost always herbaceous (99%), and nests were rarely re-used (2%). Gorillas used >40 different species of plants to build their nests, with at most 10 different species in an individual nest, however the majority of nests contained 3 species. Most of the nest construction plants were low priority food items (unpublished data). Within this inventory of plant species utilized, however, selectivity was apparent: a common ground fern (*Pteridium anquilum*) was found as the most frequently chosen plant (in 70% of all nests) and the most dominant in 60% of the nests. When present within nesting areas, *P. anquilum* was almost always chosen ( $p < 0.01$ ). Among nests constructed with only 1 or 2 species (18%), *P. anquilum* was always chosen (100%). This particular species contains cyanides (Berry 1998), and is prepared

locally as an insecticidal bath for livestock (the efficacy of which has yet to be determined). Nonetheless, further studies are suggested to investigate the role, if any, this plant has in controlling insects in gorilla night nests.

Berry, J. (1998) The Chemical Ecology of Mountain Gorillas (*Gorilla gorilla beringei*), with special reference to anti- microbial constituents. Ph.D. dissertation. Cornell University.

Reducing the subjective component in recognition of periosteal reaction. B. ROTHSCILD and C. ROTHSCILD, Arthritis Center of Northeast Ohio, Youngstown, OH 44512, NE Ohio Universities College of Medicine, Rootstown, OH 44272.

Questions as to the diagnostic implications of periosteal reactions are often related to uncertainty in its recognition. While some investigators suggest extremely high population incidences, others have not been so certain. Classic of this dichotomy is Irene Mound, variously reported as having no periosteal reaction or as afflicting one in four individuals. Our perception was intermediate. Resolving such differences of opinion would be feasible, given an objective technique to distinguish diagenesis from periosteal reaction.

The 2nd law of thermodynamics characterizes entropy, which is not a colligative property of matter. It is dependent on structure, not quantity. Since periosteal reaction represents a surface phenomenon & diagenesis alters that surface, a unique opportunity presents. The thermodynamically uniform surface of normal human bone (independent of quantity) contrasts with less entropy in diagenesis-altered bone. Thermographic patterns and entropy alterations in 251 Irene Mound tibia were compared in a blinded (as to normal, diagenesis or periosteal reaction) manner with published macroscopic findings. Comparison with macroscopic examination revealed complete entropy-based separation of diagenesis (prolonged dissipation time) from normal bone and that affected by periosteal reaction. Thermal patterns were independent of variety of periosteal reaction (striation, applique and appositional).

Variant bone entropy patterns allow true pathology and diagenesis to be distinguished. Direct correlation of thermographic findings with macroscopic identification of periosteal reaction substantiates the approach's validity.

Femoral neck cross-sectional morphology in South African early hominids. C.B. RUFF, Dept. Cell Biology and Anatomy, Johns Hopkins Univ. Sch. Med., Baltimore, MD, H.M. MCHENRY, Dept. Anthropology, UC Davis, CA, F. THACKERAY, Dept. Palaeontology, Transvaal Museum, Pretoria, S.A., L.R. BERGER, Dept. Anatomy and Human Biology, Univ. Witswatersrand, Johannesburg, S.A.

Because of its important role in transmission of load across the hip joint, the internal structure of the femoral neck has

figured prominently in interpretations of the locomotor capabilities of early hominids (Lovejoy, 1988; Stern and Susman, 1991; Ohman et al., 1997). Specifically, bipedal locomotion involving action of the gluteal abductors should theoretically produce greater asymmetry in superior to inferior neck cortical thickness by increasing relative loads on the inferior cortex. Here we report on the cross-sectional morphology of several South African early hominid femoral necks as determined by computed tomography (CT).

A Philips Tomoscan SR 7000 CT scanner housed in the Radiology Dept., Johannesburg Hospital, was used to obtain cross-sectional slices at mid-neck and at the base of the femoral neck. CT scan and display settings were empirically verified by comparison with dimensions at transverse breaks in the fossils. Inferior and superior cortical breadths at the two locations were measured manually from hard copies of the slices.

Mid-neck scans with well-preserved cortices could be obtained from six specimens: SK 82 and 97, and Stw 403, 479, 501, and 522. Base of neck scans were available for SK 82 and 97, and Stw 522. SK 82 and 97, attributed to *Australopithecus (Paranthropus) robustus*, display almost equal inferior and superior cortical thicknesses at mid-neck, with superior/inferior breadth ratios between 1.0 and 1.3. This contrasts with modern humans, who average about .5 for the same ratio, and is closer to that characteristic of African great apes (Ohman et al., 1997). Other specimens (all except Stw 479 probably attributable to *A. africanus*) are more variable, with ratios ranging between .4 and .8. All three base of neck scans show superior to inferior cortical ratios between .4 and .5, slightly above the range reported for modern humans, but well below that typical of African great apes (Ohman et al., 1997).

Thus, there is evidence among these specimens of an altered pattern of load transmission across the proximal femur relative to that in modern humans, in which the inferior cortex at mid-neck bears relatively less load (like great apes), while more lateral regions of the neck have a more human-like load distribution, although still somewhat intermediate between that of humans and quadrupeds.

Supported by a grant from the L.S.B. Leakey Foundation.

Brain size and cognitive ability: A review with new evidence. J. P. RUSHTON, Department of Psychology, University of Western Ontario, London, Ontario, Canada N6A 5C2,

Using data from magnetic resonance imaging (MRI), autopsy, endocranial measurements, and external head measurements, Rushton and Ankney (1996, *Psychonomic Bulletin and Review*) show that brain volume correlates about 0.44 with cognitive ability in eight studies using MRI and about 0.20 using other techniques. As such these data confirm Van Valen's (1974) review in *AJPA* estimating a correlation of about 0.30 between brain volume and cognitive ability from external head circumference.

This paper corroborates the correlation of about 0.40 between brain volume and cognitive ability with an analysis of subsequent MRI studies. It also presents new results on head circumference and IQ test scores from an analysis of the 53,000 children followed from birth to 7 years by the Collaborative Perinatal Project. Head circumference at birth is found to correlate about .50 with head circumference at age 7 which correlates 0.21 with IQ test scores at age 7. Even head circumference at birth correlates with IQ at age 7 at

about 0.12. (Head circumference and other external head measurements correlate 0.50 and higher with MRI measured brain volume.) Socioeconomic status relates to both head circumference and IQ.

Future research, using modern imaging techniques, while controlling for more variables, may resolve outstanding questions. However, what is already known from such state-of-the-art techniques clearly validates the direction of the brain-size/cognitive ability relationship described by Paul Broca (1824-1880), Francis Galton (1822-1911), and other nineteenth-century visionaries. The null hypothesis of no relation between brain size and cognitive ability, strongly advocated over the last half century, must be dismissed.

Anthropometric determinants of biological risk factors for cardiovascular disease in Mexican Americans from the Third National Health and Nutrition Examination Survey (NHANES III, 1988-1994). A.S. RYAN, Ross Products Division, Abbott Laboratories, Columbus, OH 43215.

This study evaluated the relationship of measures of body fatness (weight, BMI, sum of skinfold thicknesses), and indices of adipose tissue distribution (waist/hip ratio, ratio of the trunk to extremity skinfold thicknesses, T/E) with biological markers for cardiovascular disease (cholesterol, HDL, LDL, and triglycerides) in a sample of Mexican-American men (n=2175) and women (n=2057) aged 20 to 90+ years who were included in the Third National Health and Nutrition Examination Survey (NHANES III, 1988-1994). Anthropometric measures that were significantly related to biological risk factors for cardiovascular disease are shown in the table.

Variable	Cholesterol <sup>1,2</sup>	HDL <sup>3</sup>	LDL <sup>4,5</sup>	Triglycerides <sup>6,7</sup>
Sex	NS	NS	NS	NS
BMI	NS	NS	NS	.001 <sup>6</sup> , .01 <sup>7</sup>
Age	.001 <sup>1</sup> , .05 <sup>2</sup>	NS	.001 <sup>4,5</sup>	.02 <sup>6,7</sup>
Waist/hip	.02 <sup>1</sup> , .01 <sup>1</sup>	.01 <sup>3</sup>	NS	.001 <sup>6,7</sup>
Weight	NS	NS	NS	NS
T/E	.001 <sup>1,2</sup>	.001 <sup>3</sup>	NS	.001 <sup>6</sup> , .01 <sup>7</sup>
Σ skinfolds	.02 <sup>1</sup> , .03 <sup>2</sup>	NS	.001 <sup>4</sup> , .05 <sup>5</sup>	NS

<sup>1</sup> ≥ 200 mg/dl, <sup>2</sup> ≥ 240 mg/dl, <sup>3</sup> < 35 mg/dl, <sup>4</sup> ≥ 130 mg/dl, <sup>5</sup> ≥ 160 mg/dl, <sup>6</sup> ≥ 150 mg/dl, <sup>7</sup> ≥ 200 mg/dl, NS = not significant

Logistic regression analyses indicated that, after controlling for cigarette smoking and alcohol use, the waist/hip ratio was the strongest predictor for 3 of 4 risk factors for cardiovascular disease. Mexican-American men and women with a large waist/hip ratio were more likely to have high levels of cholesterol (≥ 200 or ≥ 240 mg/dl) and triglycerides (≥ 150 or ≥ 200 mg/dl) and low levels of HDL (< 35 mg/dl) than those with a small ratio.

Non-invasive molecular genetic studies of gorillas: Evolutionary and systematic implications. O.A. RYDER, K.J. GARNER, and W. BURROWS. Center for Reproduction of Endangered Species, Zoological Society of San Diego, San Diego, CA 92112.

The development of non-invasive methods of genetic analysis has greatly contributed to our understanding of the phylogeography, systematics, and population genetics of gorillas. Implications of high levels of mitochondrial DNA diversity in gorillas have been confirmed.

Within gorillas, mitochondrial DNA evidence suggests that more than one species exists. The eastern gorillas (*Gorilla gorilla beringei* and *G.g. graueri*) differ from western gorillas (*G.g. gorilla*) by a number of mutational differences consistent with the level of genetic differentiation between *Pan troglodytes* and *P. paniscus*, and approaching that of *Homo* and *Pan*. Western gorillas exhibit deep divergences in their mitochondrial DNA lineages, also approaching the level of divergence exhibited between *P. paniscus* and *P. troglodytes* in the mitochondrial DNA control region. Each subspecies of gorilla in the eastern portion of the range shows a relatively greater degree of genetic homogeneity. Mountain gorillas (*G.g. beringei*) from the Karisoke region and from the Bwindi Impenetrable Forest share the same most common haplotype which differs minimally from the minor haplotypes. Grauer's gorillas (*G.g. graueri*) also show relatively little nucleotide sequence diversity. Populations widely separated in their described range show no significant variation. Molecular evidence to date supports the current taxonomy in identifying two taxonomic units in the eastern portion of the species' range. The question of how many subspecies/species exist within the current western lowland gorilla population requires further investigation.

Primate dental development and the reconstruction of life history strategies in subfossil lemurs. K.E. SAMONDS, Anatomical Sciences, SUNY at Stony Brook, NY 11794, L.R. GODFREY, University of Massachusetts at Amherst, MA 01003, W. L. JUNGERS, and L.B. MARTIN, SUNY at Stony Brook, NY 11794.

Accelerated dental development and eruption among the Indridae are correlated with a number of behavioral and morphological characteristics, including early acquisition of adult competence in foraging and low mandibular and

maxillary dp4/M1 occlusal area ratios. The deciduous teeth erupt early and are replaced at a very young age. Indrids are also unique among extant primates in having milk teeth that are essentially vestigial. In order to better understand accelerated dental development in indrids, we explored the dental developmental correlates of dietary variation across the order Primates, attempted to characterize the dental developmental differences between strepsirrhine and non-strepsirrhine folivores, compared the indrids to other folivores and seed predators, and explored the phylogenetic and life history correlates of variation in dental development in other lemurs.

Our analysis illustrates the degree to which indrids depart from other types of living lemurs and from anthropoids of comparable body sizes. When compared to their living relatives, the leaf-eating subfossil lemurs (the sloth lemurs or Palaeopropithecidae and Megaladapidae) have a high megadonty index (cheek teeth that are large for their skull size), and the Palaeopropithecidae appear to follow very accelerated, indrid-like schedules of dental development and eruption.

Work is in progress to test the hypothesis of accelerated dental development in the Palaeopropithecidae more directly, using histological sections and interpreting enamel microstructure (e.g., an unerupted canine has been extracted from the skull of a young *Palaeopropithecus ingens*). Relative acceleration of dental ontogenesis can be assessed using these tools of analysis. This can, in turn, help us to reconstruct the life history strategies, behavioral ontogeny, and phylogeny of these subfossil lemurs.

Supported in part by NSF grant SBR-9630350

#### "All God's Children": Subadult health in a Byzantine Jerusalem monastery

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Exhumation of crypts associated with a large urban Byzantine monastic site in Jerusalem (St. Stephen's) has yielded over 15,000 human bones, a quarter of which are those of children. The purpose of this investigation was to reconstruct a morbidity and mortality profile of the subadult remains. Age was estimated using dental eruption, long bone length, and epiphyseal fusion; auricular surface morphology was analyzed for sex determination. Nutrition and disease patterns were also investigated.

Subadults aged 7 months *in utero* thru 18 yrs were found (n=3,004 bones). The average age at death was between 2-3 yrs, with a sharp decline after age 6 yrs. None of the auricular surfaces analyzed (n=52) appeared female, although it should be cautioned that the 'default' morphological pattern for this feature is male. No cases of subadult cribra orbitalia were found (n=24). However, when dental and skeletal ages were compared, bone growth showed a significant ( $p<0.05$ ) lag behind dental eruption. Periosteal lesions on 9 long bones were found, as were 5 cases of deciduous dental caries, and 1 greenstick fracture.

In summary, the children reached peak mortality at an age associated with weaning. Those that survived showed little evidence of nutritional deficiency (cribra orbitalia), however the lag between their dental and skeletal maturity hints at some environmentally-induced physiological stress. The low incidence of systemic infectious lesions, carious

lesions, or trauma such as fractures, suggests a relatively healthy lifestyle.

The role of the subadults in this monastic community remains a mystery. Historical accounts speak of the presence of oblates (young monastics) in Byzantine monasteries of the Near East, however there are significant precautions against accepting individuals under the age of 5 yrs. Many monasteries of the period had an associated orphanage, and it is possible that St. Stephen's was no exception. However, though numerous texts are available for the site, there is no mention of such a function. It is also possible these remains represent children raised in the surrounding community, buried on the monastery grounds due to its location near the bones of a martyr (St. Stephen). Further analysis of the historical records, as well as comparison of the childhood health patterns to those of the adult segment of the community should help establish the genesis of these children at this urban Jerusalem monastery.

\* This research was supported by the Fulbright Foundation, the National Endowment for the Humanities, and the University of Notre Dame's Institute for Scholarship in the Liberal Arts.

#### The hidden contribution: Genetic and demographic evidence of Amerindian admixture in Uruguayan populations. Mónica Sans<sup>1</sup>, Carolina Bonilla<sup>1</sup>, Isabel Barreto<sup>1</sup>, Gabriel Cavazos<sup>2</sup>, and D. Andrew Merriwether<sup>2</sup>.

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Recently, genetic studies of nuclear markers have shown that the Amerindian contribution in Uruguay vary from 1% to 20% depending on the region. Some historical data assert that this native people which have integrated to the Uruguayan population is mostly of Guaraní origin and came from the Jesuitic Missions.

In this paper, we show the results of the mtDNA analysis in Cerro Largo, in the northeastern part of the country, and we compare them with data obtained in Tacuarembó in the same region. With regards to the maternal lineages, the Amerindian contribution reaches 39% and 59% respectively, thus we conclude the influence of directional matings. Also, the frequencies of mtDNA haplotypes (24% A, 35% B, 32% C, 6% D, and 3% X in Cerro Largo, and close to these in Tacuarembó) make possible to relate the origin of the Amerindians with those populations living in the Amazonian area.

We discuss the genetic information using historic and demographic data, mostly from archives of the Catholic church. We focus the analysis on the marriages between Amerindian women and Spanish or Portuguese men, with special reference to the origin of women (Guaraní or other Amerindian ethnic group), and on the role of Amerindian males in the Spanish and Uruguayan societies. Finally, we make an attempt to re-write a hidden part of the Uruguayan history: the way Amerindian people integrated into European society from the 17th to the 19<sup>th</sup>.



Clues potentially distinguishing cerebral palsy in bioarchaeological analysis. A. SANSONE, Dept. of Anthropology, SUNY at Albany, NY 12222.

Current paleopathological diagnostics only broadly describe neurological injuries in skeletal samples. Neurological injuries, however, result in observable neuromuscular impairments that impact the skeleton and can therefore distinguish the type and location of a lesion within the nervous system. This study attempts to quantitatively and qualitatively specify the type and location of a neurological injury as evidenced in a skeleton from a late 19<sup>th</sup> century skeletal series.

Cerebral palsy (CP) is defined as a disorder of movement and posture due to a defect or lesion of the immature brain. The non-progressive brain lesion interferes with the maturation of the CNS, ultimately resulting in impairment of the coordination of muscle action. Researchers have classified gross motor functional impairments based upon characteristic abnormal motor 'reflexes' and movement diarchies in individuals with CP.

Postcranial remains of Burial no. 10 of the Oneida sample from a New York 19<sup>th</sup> century almshouse are compared with 10 individuals within the same skeletal series. Ratios of areal measurements of muscular markings to bone girth measurements are analyzed for upper and lower extremity remains via a 2-D digitizer (UTHSCA ImageTool). These measurements serve as a comparative basis for assessing burial no. 10's pattern of muscular markings and bone girth measurements. Further indication of a CP lesion is evidenced by irregularities within the morphology of the mandible. The results are correlated to definitions of CP gross motor movement and postural features for either Type I or II / Diarchy I or II CP lesions.

Tuberculosis in young Portuguese earlier this century: a radiological study. A.L.SANTOS, Departamento de Antropologia, Universidade de Coimbra, 3049 Coimbra Codex, Portugal and C.A.ROBERTS, Calvin Wells Laboratory, Department of Archaeological Sciences, University of Bradford, Bradford, BD7 1DP, U.K.

The aim of this study was to examine the evidence, and consider the differential diagnosis, for tuberculosis (TB) in non-adult individuals. Sixty-six individuals from both sexes in the Coimbra Identified Skeletal Collection are non-adults with ages at death ranging from seven to twenty-one years. Eighteen of these individuals died from different types of TB, as follows: pulmonary TB (10), tuberculous meningitis (3), bone and joint TB (1), tuberculous enteritis (1), TB and pulmonary congestion (1), peritoneal TB (1), and pulmonary TB and heart attack (1). Distribution of the skeletal manifestations of TB as seen radiologically were recorded and are discussed with reference to the types of TB observed macroscopically. This work, based on data before antibiotics were developed for TB treatment, can contribute to future identification of non-identified

skeletal material, and help with more reliable diagnoses of TB in non-adult individuals.

This research is supported by the Prodep Doctoral Programme, University of Coimbra.

Conflict and post-conflict behavior in a small group of chimpanzees (*Pan troglodytes*). C. SANZ<sup>1</sup> and A. FUENTES<sup>2</sup>, <sup>1</sup>Dept of Psychology and Chimpanzee and Human Communication Institute, <sup>2</sup>Dept of Anthropology, Central Washington University.

Conflict and post-conflict behavior were recorded for a small group of socially housed chimpanzees over two six-week periods in consecutive years (1997-98). Post conflict/matched control data collection resulted in a total data set of 60 conflicts. Twenty-three conflicts also contain additional data on conflict quality and inter-individual proximity. A comparison of the two data collection periods demonstrates the chimpanzees' tendencies to maintain visual contact and closer proximity after conflicts. Each chimpanzee's impact on group totals for reconciliation, consolation and redirection are presented. Consolation with human caretakers and redirection of aggression towards humans also occurred. These data suggest that conflict and proximity data collection should be included in post-conflict behavior studies. Also, these results prompt an examination of caretakers' roles during captive chimpanzee conflicts.

**Comparison between factorial and heart rate monitoring methods in assessing energy expenditure.** I. SARTON-MILLER and P. A. KRAMER Department of Anthropology, University of Washington, Seattle WA 98195.

Daily energy expenditure is often used to assess nutritional status in third world countries, even though its validity is debatable and dependent on technique. Four indirect calorimetry techniques are often available: doubly labelled water, whole-body chamber, factorial and heart rate (HR) monitoring methods. The first two methods are either too expensive or inappropriate for fieldwork, factorial and HR methods are practical for the field. In the factorial method, energy expenditure is expressed as BMR x a metabolic constant for an activity x the duration of the activity. Recorded heart rates, which are assumed to be correlated with oxygen consumption are converted into caloric equivalent from an established oxygen consumption-heart rate relationship. Many authors have compared these two methods and concluded that the factorial method underestimates energy expenditure. The cause of this underestimation is not clear. While it is known that the

factorial method is based on BMR values derived from Euro-Americans, most of the comparative studies are done in third world countries where either the BMR or metabolic constants may be different. Further, factorial techniques usually depends on recall interviews, which may impart an important bias. Finally, over reporting may occur in the heart rate method because the relationship between HR and the oxygen consumption does not hold well for small values of HR.

The present study compares these two techniques using data collected from adult males and females at sea level (Seattle, WA). BMR was measured as well as the relationship between heart rates and oxygen consumption for different intensities of exercise. The oxygen consumption was measured with an oxylog and the heart rates with a polar HR monitor, which consists of a chest strap and a wrist watch. Once the relationship between HR and oxygen consumption was established, each adult wore the HR monitor and was followed for 4 hours. Activity and duration were recorded. Measurements needed by both methods were recorded simultaneously, thus removing recall bias. Energy expenditure using the factorial and HR methods are compared and the differences are discussed.

How can mathematical models help the dead to speak?  
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Archival research is frequently centered on studies of the records of people who are no longer alive. These records are often a very rich source of information about the past. However, their use usually requires a researcher to read and analyze a large amount of material. Moreover, even the richest data set may not contain the information needed most to answer questions of interest, and because the subjects are no longer alive, it can be difficult or impossible to fill in existing gaps in the records.

Mathematical modeling can be a valuable aid in overcoming these problems. Well-designed models can be used to identify the types of data that are most important in answering questions about the past and can help direct a researcher to those historical records of greatest value to the study. Good models can also be used to delineate the realm of possibilities for data that may be unavailable in the archival records so that a researcher can begin to move beyond the limitations of the data and address questions of interest.

The process of modeling is a feedback process where insights from analysis of the historic record are used to develop a model, simulations of the model are run, results of the simulation are compared to data derived from the analysis of the historic record, the model is modified and the historic record is searched for additional data needed for the new model, new simulations are run and compared to actual data, etc., until the model adequately represents the real situation. This process and the way it can be used to focus historical studies and overcome data limitations will be illustrated by studies of the spread of influenza in the central Canadian subarctic.

Skeletal evidence for an early date for European presence in Western New York. L. P. SAUNDERS, Rochester Museum and Science Center, Rochester, NY 14607.

The advent of European presence in North America has been documented both archaeologically and ethnohistorically, the latter discipline tending to provide

the earliest dates. In western New York, the archaeological evidence of European trade materials indicates the presence of European culture in the area prior to the dates indicated by the ethnohistorical record. Clearly, the movement of European cultural materials into Seneca territory predates the arrival of the people themselves, by several decades at least. The time difference may not be as pronounced as had been assumed, however. A re-evaluation of skeletal remains from the Seneca Dutch Hollow site has revealed that one of two adult males in an unique double burial – the only one with complete superimposition of individuals in a multiple interment – appears to be Caucasian. It is possible that this is the earliest evidence of the physical presence of a European in Seneca territory. This evidence, and the impact of European culture on Seneca life, is discussed.

An analysis of the dentition of a living wild population of ringtailed lemurs (*Lemur catta*) M.L. SAUTHER, F.P. CUOZZO, University of Colorado, Boulder, CO 80309-0233 and R.W. SUSSMAN, Washington University, St. Louis, MO 63110.

The study of extant primate dentition has long been recognized as an integral aspect of primate evolutionary biology. Nevertheless, detailed descriptions of the dentition of many primate taxa have been limited. This is the case for the Malagasy strepsirrhine species, *Lemur catta*. While several recent studies have provided detailed morphological descriptions of ringtailed lemur dentition (e.g. Schwartz and Tattersall, 1985; Tattersall and Schwartz, 1991), there are few studies (e.g. Eaglen, 1986) that present any quantitative data on the dentition of this species. Furthermore, prior analyses have been based on museum specimens from various populations and locations. We present here quantitative and morphological data on dentition of a living population of wild *L. catta* from Beza Mahafaly Special Reserve, Madagascar.

Dental casts were made from members of the *L. catta* population as a part of a long term study of ringtailed lemur demography and life history. Measurements were made from these dental casts and are based on a sample size of  $n=25$ . An analysis of these data indicate no significant ( $p<.05$ ) sexual dimorphism exists in canine length or widths, lower molar length, tooth-comb length, or palate breadth. These comparisons support most of the observations of Schwartz and Tattersall (1985) in terms of metric dental patterns. However, several contrasts exist. For example, in the current data set,  $M_3$  is longer than  $M_1$  in 66% of the specimens, while Schwartz and Tattersall write that  $M_1$  is slightly shorter than  $M_3$ . Analysis of the dental morphology also found most of Schwartz and Tattersall's species-specific observations, including ledge-like cingula on  $M^{1-2}$  and a distinct lingual talonid groove on  $M_1$ .

These data support the generalizations (e.g. Jenkins and Albrecht, 1991; Plavcan and van Schaik, 1994; Kappeler, 1996) that little sexual dimorphism exists among the Malagasy strepsirrhines. However, a substantial amount of intraspecific morphological and quantitative variation is also indicated. As the current data set also includes detailed life history and ecological data for each specimen, the results of this study will provide much basal data for further analyses.

Cholera, politics and health: an examination of the Vulgar Disease in 19<sup>th</sup> century Gibraltar. L.A. SAWCHUK, Department of Anthropology, University of Toronto, Scarborough Campus, Scarborough, Ontario, Canada M1C 1A4.

Epidemics of cholera struck the British Colony of Gibraltar five times during the 19<sup>th</sup> century. Other than in 1834 when 380 deaths occurred, the 1865 epidemic was the most destructive with 507 deaths in a population of about 18,000 inhabitants. During this 4<sup>th</sup> pandemic of cholera, deaths were not equally distributed among the residents of Gibraltar (e.g., the death rate among convicts was 63.5/1000 while only 8.3/1000 among Jewish inhabitants). Detailed house-by-house analysis indicates that the death rate among the civilian community varied according to wealth with the poorer districts exhibiting cholera death rates in excess of 40 per 1000, while those residing in the wealthier districts displayed rates below 20. Further mortality correlates were observed according to building size, as cholera death rates rose from 11.6/1000 in single dwelling buildings to 20.4/1000 among large multi-family dwellings (10 or more families). Mortality during the 1865 epidemic was exacerbated by the outbreak of smallpox as well as the imposition of a four month blockade or quarantine on Gibraltar. The issue of a quarantine, specifically a pallenque, acted as a powerful stressor through decreased trade, higher unemployment and poorer nutrition among Gibraltar's inhabitants.

Interpositional and intraspecific variations of primate phalangeal morphology. M SCALABRIN, Department of Anthropology, Southern Illinois University, Carbondale, IL 62901.

Previous studies have indicated a general trend in manual phalangeal curvature from less curvature in terrestrial primates to greater curvature in suspensory species. This study examines curvature in arboreal primates to further our understanding of phalangeal morphology and its response to environmental stresses.

Ten individual measurements were taken on the proximal and intermediate manual phalanges of digits II and III from seven primate species: *Cebus apella*, *Pithecia pithecia*, *Ateles geoffroyi*, *Alouatta seniculus*, *Colobus guereza*, *Hylobates concolor*, and *Pongo pygmaeus*. Computer analysis was also used on digital photographs to provide an alternative method for determining degree of curvature.

Statistical analyses show significant differences in phalangeal morphology between individual digits and between groups differing in positional patterns. Preliminary results indicate that suspensory primates have more shallow and squared proximal articular

surfaces on the proximal phalanges (as predicted for greater mobility in the digits) while arboreal quadrupeds have deeper articulations for greater support. Digital analyses indicate that there is 1) a larger degree of curvature in the proximal (vs. intermediate) phalanges, 2) more curvature in digits II than III, and 3) a difference in the degree of curvature between the proximal and distal portions of each phalanx (up to 20-30° within intermediate phalanges)

These results confirm earlier conclusions regarding correlations between positional behavior and overall phalangeal morphology. In addition, this study suggests that: 1) curvature in the phalanges is not a symmetrical arc, and 2) intraspecific variations should be considered when relating phalangeal morphology to primate positional behavior and to the fossil record.

This research was supported by Sigma Xi Grants-In-Aid of Research

Sleep behavior and activity patterns in pre-teen and adolescent girls residing in suburban Seattle. DE SCHECHTER, Department Anthropology, University of Washington, Seattle, WA 98195-3100

Pediatricians and psychologists are concerned that adolescents are not getting enough sleep. This conclusion is based on research that shows a level of afternoon sleepiness in adolescents that is not found in young children or adults. Research on circadian rhythms has shown that children residing in urban areas have a very different circadian sleep phase from that of adolescents; children prefer to go to bed early and rise early, while adolescents prefer to go to bed late and rise late. It is proposed that this phase difference is a biological consequence of hormonal changes associated with the onset of puberty. These conclusions are based on western urban populations and may not be generalizeable. This paper reports on the feasibility of field measures to quantify sleep, sleepiness, degree of sexual maturation and diaries for recording daily activities.

Preliminary data were collected on a sample of 10 girls aged 7 to 18 residing in suburban Seattle. Each girl was asked to participate in the study for a one week period in order to contrast sleep and activity patterns from school days versus weekends. During the data collection period, participants were asked to wear an Actiwatch<sup>®</sup> activity monitor (Minimitter, Sunriver, Oregon) and keep a daily diary of their activities. Other measures included an afternoon sleepiness test using a "deadman" (DM) switch and a self-report on degree of sexual maturation using photographs of Tanner stages.

The results of the pilot study support previous research on sleep patterns in children and adolescents, but underscore the need for the development of reliable qualitative measures of time allocation to daily activities. The utility of the Actiwatch and DM switch as field measures in a non-western setting is discussed.

Modern Cemeteries as Research Resources: The Spring Grove Project  
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Anthropology, University of Cincinnati, 45221-0380

Modern cemeteries with historical time depth and detailed documentation can serve as excellent sites for testing models of mortuary behavior that have direct application to our understanding of prehistoric burials. Their role as 'mirrors of society' has long been recognized, but their potential use for evaluating assumptions underlying the theoretical basis of mortuary analysis (Saxe, 1968; Binford, 1971) is largely overlooked.

The use of modern cemeteries enables researchers to control many key variables that are unknown, estimated, or inferred for prehistoric settings. Factors such as age and biological gender are known, and in some cases interment ceremonies and perishable treatment of the grave can be studied. Ethnicity can be documented from country of origin or approximated from names, and actual financial status, social class and professional or social affiliation can be compared with the predictions of these variables as expressed by mortuary architecture.

For the past four years, students at the University of Cincinnati have investigated mortuary behavior at Spring Grove Cemetery, a large urban parkland burial ground with interments dating from the revolutionary war period to the present day. Their studies examine issues of sampling bias in mortuary analysis, the relationship between mortuary architecture and status, the differential treatment of males and females through the lifespan, and how the burial treatment of women changes in response to significant socio-historical developments in Cincinnati and American history such as the educational and employment opportunities following W.W.II.

At Spring Grove, the burial treatment of females reflects both individual status and social roles (including marriage status). Family traditions, especially those affecting the similar treatment of spouses, seem to be the primary determinants of female burial treatment, but even those conservative factors show variation and temporal trends that relate to changing female status in Cincinnati society.

Recognizing the strangeness of nonverbal behavior cross-culturally  
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Indiana University of Pennsylvania, Indiana PA 15705

Nonverbal behavior in schizophrenia plays an important part in the designation of patients as mentally ill. In addition to general flattening of expression, there may also be unusual expressions or unusual patterns of expression. This research addressed whether or not a group of evaluators from New Zealand would be able to recognize not only flattened expression, but also *specific* aspects of unusual nonverbal behavior in Papua New Guinean patients.

Evaluators were asked: "Do you notice anything unusual or strange about this subject? If yes, what in particular strikes you about his or her expression?" They were expected to respond positively more often when viewing videotape of patients. Evaluators recognized strange behavior in 10.5% of all videotaped segments evaluated for patients. However, they also found 7.8% of control segments to be strange or unusual. Apparently, both schizophrenia and an unfamiliar culture

contributed to the "strange" appearance of nonverbal expression cross-culturally.

Patients varied widely in the responses they elicited; several patients appeared "strange" many times (16-20% of video segments observed). Specific expressions observed in these particular patients were investigated more closely to determine if they were unique to the patients studied, or similar to expression observed in people with schizophrenia from other countries.

Results of this research are discussed with respect to the importance of hand movements and eye contact in communication and implications for the evolution of nonverbal expression in humans.

Intact protein molecules in archaeological bones – Bone matrix as a treasure chest of ancient diseases and living conditions. T.H. SCHMIDT-SCHULTZ and M. SCHULTZ  
Center of Anatomy, Göttingen University (Germany).

It is already known that there is a relationship between the burial environment and the preservation of bone (diagenesis) and that there are interactions between inorganic bone matrix and protein structures which is an important factor in controlling the decay process. It has now become clear that human and animal bones are an important archaeological resource for the molecular investigation of ancient diseases and living conditions. The investigation of bone morphology at the microscopic level yields exact data on the preservation of bony tissue in archaeological skeletal remains. For further investigation at the molecular level, a special method has been established. Extracted proteins are analyzed by separation according to their molecular weight (SDS-gel-electrophoresis) and identified by Western blotting.

Bone samples from different early medieval cemeteries in southern Germany representing different degrees of preservation, as well as recent bone samples from the anatomy department (formalin fixed for a minimum of one year) and from the pathology department (fresh) were used. The results show that in fresh and in very well preserved archaeological bone samples, clear patterns of approximately 20 protein bands in the range of 10 kd to more than 100 kd were found (collagen and non-collagen proteins). These bands correspond to each other in their main pattern, although their intensities can vary. The formalin fixed and the poorly preserved archaeological samples yield only one or two faint bands or even negative results.

The different protein patterns yield reliable diagnoses of diseases and help in the understanding of ancient living conditions.

Shock wave transmission through the human body during normal and compliant walking. D. SCHMITT, P. LEMELIN, and A.C. TRUEBLOOD. Department of Biological Anthropology and Anatomy, Duke University Medical Center, Durham, NC 27710.

During normal human walking, the body is subjected to abrupt impact forces each time the heel



strikes the ground. These forces propagate through the body and are believed to be responsible for a wide variety of stress injuries and degenerative arthritis. However, these forces can be attenuated by the locomotor system or by changes in body stiffness. Studies of human running have shown that impact forces can decrease substantially with increased hip and knee flexion.

In this study, we quantified normal shock attenuation for a sample of 360 steps from healthy, young male and female adults. Subjects were outfitted with low-mass, skin-mounted piezoelectric accelerometers to record impact shock at the distal tibia, sacrum, and head. Magnitude of the impact spike at heel strike was recorded at all three positions during normal and "compliant" (bent-hip, bent-knee) walking.

The results show that during normal walking, the impact spike experienced at the sacrum and the head were 2.8 and 3.3 times smaller respectively than those experienced at the ankle. The force magnitude at the sacrum and head are 6.1 and 9.5 times smaller respectively than those experienced at the ankle when subjects walk with deeply bent hips and knees.

Clearly, our experiments demonstrate that the adoption of a compliant walking gait significantly improve the ability of a person to attenuate heel-strike impact forces. Early hominids had less stabilized hind limb joints and sacra, smaller femoral heads, and smaller vertebral centra compared to modern humans. Thus, the postcranial anatomy of australopithecines was probably not as well suited to attenuate impact shocks during bipedal walking. However, the adoption of a bent-hip, bent-knee gait could have significantly reduced heel-strike impact shocks experienced by early hominids.

Relationships between prefrontal volume and behavior in normal human females.

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Not only did the hominid brain increase more than three-fold in size during our evolutionary history, but it appears that certain areas of the brain contributed more to this increase than others. In particular, the prefrontal region appears to be twice as large (considered as a percentage of cortical surface area) as homologous regions in non-human primates.

It is not clear why this region of the brain shows such a disproportionate increase. The prefrontal region is not involved in primary sensory processing, but rather appears to be important for higher-order cognitive tasks, such as planning and strategy. Areas in the prefrontal cortex also appear to be important for breaking perseverative tendencies, and for memory of serial order. However, whether variability in prefrontal volume and/or surface areas may be correlated with specific behavioral abilities has not been extensively investigated in normal humans.

The present study assessed the extent to which prefrontal volumes and surface-areas correlate with a

variety of psychometric tests, both between- and within-families. 36 pairs of sisters (72 individuals total) were given a diverse battery of cognitive tests that included four tests known clinically to show prefrontal specificity: STROOP, TRAILS, WCST, and VERBAL FLUENCY. High-resolution MRI brain scans (voxel size: ~1.3 mm<sup>3</sup>, with no gaps between slices) were obtained, from which prefrontal volumes and surface were quantified. Within- and between-family correlations were calculated (controlling for age and simple reaction time) among the behavioral and neuroanatomical variables.

The results showed that between-families two tests correlated significantly with prefrontal volumes: STROOP and TRAILS. Within-families, the STROOP test (but not TRAILS) remained significant. These findings suggest that significant correlations may exist between localized neuroanatomical volumes and specific cognitive abilities. Details of the STROOP and TRAILS tests are given, and possible evolutionary implications of these findings are discussed.

Meningeal diseases in infancy from prehistory to Early Modern Times. – M. SCHULTZ, Center of Anatomy, University of Göttingen (Germany).

To clear up the history of meningeal diseases, a total of 2714 child skeletons dating from the Mesolithic to the Late Middle Ages/Early Modern Times were examined by macroscopic, radiological, endoscopic, light and scanning-electron microscopic techniques.

Bacterial meningitis was not diagnosed in the Mesolithic and very Early Neolithic Times when man was living as a hunter-gatherer. In Neolithic Times, once the sedentary way of life had been established only a few cases of hemorrhagic-inflammatory meningitis were diagnosed. In the Old World, during the Early and the Middle Bronze Age as well as during the Late Bronze Age and the Iron Age meningeal diseases remained relatively rare while in the Middle Ages the frequency became extremely high. This increase in hemorrhagic-inflammatory diseases correlates with the increase in infectious diseases in the middle ear region and the paranasal sinuses.

For the European Early Middle Ages, a gradually increasing incidence of tuberculous leptomeningitis was observed in a few populations. In the Late Middle Ages and in Early Modern Times, the frequency of tuberculous leptomeningitis increased dramatically and was probably caused not only by a weakening of the immune system, but by the continuous population growth and the deterioration in the economy and the political situation.

Changes in infant nutrition with the evolution of food production: isotopic evidence from the North American Midcontinent. M. R. SCHURR and M. L. POWELL, Department of Anthropology, University of Notre Dame, Notre Dame, IN 46556.

Changes in infant feeding practices and nutrition have often been suggested as important causes for population

growth during and after the evolution of food production. Stable nitrogen-isotope ratios of collagen extracted from juvenile and adult burials from four sites in midcontinental North America are compared with osteological and demographic measures of health to evaluate theories about changes in infant nutrition and childhood health after the appearance of food production. Two pre-agricultural Late Archaic sites (Indian Knoll [15Oh2] and Carlston-Annis [15Bt1]) are compared with two highly agricultural Middle Mississippian sites (Angel [12Vg1] and Tinsley Hill [15Ly18]).

As expected, there were significant differences in adult and childhood diets when the Archaic sites are compared to the Middle Mississippian ones. There were also differences between the two Late Archaic sites when they are compared to each other, with much higher nitrogen-15 levels at Indian Knoll. However, previous comparisons of mortality and morbidity at these two sites have revealed only minor differences in age-specific death rates, life expectancy at birth and adolescence, and prevalence of infectious disease reaction, anemia, dental pathology, and trauma. The isotopic data provide little evidence for changes in weaning time between the four sites. When compared to the Archaic sites, the demographic profiles of the Middle Mississippian sites suggest slightly infant higher mortality, fertility, or a combination of these at the later sites. It is difficult to attribute these differences to changes in infant feeding practices with the advent of agriculture based on the isotopic data.

Made possible in part by support from the Institute for Scholarship in the Liberal Arts, College of Arts and Letters, and the Center for Environmental Science and Technology, Notre Dame.

Reevaluating Siberia as a Source Area for Ancestral Native American Populations. TG SCHURR and JT LELL, Emory University, RI SUKERNIK and EB STARIKOVSKAYA, Institute of Cytology and Genetics, Novosibirsk, and DC WALLACE, Emory University.

Recent studies of mtDNA variation in Native American populations have suggested that the region encompassing southeastern Siberia and Mongolia was the homeland of ancestral Native Americans. However, amongst the populations inhabiting this region, the four major haplogroups seen in Amerindians (A-D) comprise only 30-55% of their haplotypes, with the rest belonging to other Asian mtDNA lineages not present in the New World. In addition, haplotypes from haplogroup X, a fifth founding mtDNA lineage in Amerindians, were not present in these Asian populations, and only haplogroups A, C and D were present in the vast majority of native Siberian groups. These data tend to argue against the occurrence of a single migration from southeastern Siberia bearing these mtDNA lineages to the New World, and suggest that there were multiple source areas for the haplogroups present in Native Americans. Moreover, the presence of the same haplogroups in Asia and the Americas may not in itself provide sufficient evidence to clearly identify the potential homeland of ancestral Native American groups, as

recent studies show that the underlying diversity and substructure of these mtDNA lineages give greater information about the genetic links between Asians and Native Americans than haplogroup frequencies alone. From a Y-chromosome perspective, at least two major paternal lineages appear to have been part of the initial colonization of the New World, as defined by DYS199 alleles. In addition, two other major paternal lineages arose and expanded into eastern Siberia after the colonization of the Americas, with these apparent originating in different regions of Siberia/Asia. There was further evidence of the reexpansion of DYS199C haplotypes into northeastern Siberia, although these exhibited different DYS19 STR profiles than those first brought to the New World. Overall, these data imply that the colonization of Siberia and the Americas was a more complex process than suggested by some recent models, one in which multiple expansions of ancient peoples contributed to the genetic diversity observed in aboriginal Siberian and Native American populations.

The ontogeny of locomotor behavior in captive chimpanzees: comparison with wild chimpanzees. M.L. SCHWANDT, Department of Anthropology, Arizona State University, Tempe, AZ 85287.

Doran (1992) demonstrated that the locomotor behavior of wild chimpanzees (*Pan troglodytes*) changes during development. Most notably, suspensory locomotion decreases while quadrupedalism increases with increasing age. The purpose of this study is to compare age changes in the locomotor behavior of captive chimpanzees with published data on wild chimpanzees. In addition, data on age changes in the postural behavior of captive chimpanzees are also presented.

Data on the positional behavior of chimpanzees at the Primate Foundation of Arizona were collected over a period of two years using instantaneous focal animal sampling. The age classes and locomotor behavior categories described by Doran (1992) were utilized in analysis. In both wild and captive chimpanzees, the frequency of quadrupedalism increases from infancy to adulthood while climbing behavior decreases. In the wild, suspensory locomotion is high in infants, then decreases with age. In contrast, captive young infants engage in less suspensory locomotion than chimpanzees over 2 years of age. During quadrupedalism, 6 to 24 month-old infants in the wild use a mix of knuckle-walking and palmigrade locomotion, while captive infants of comparable age exhibit only knuckle-walking.

Results for postural behavior indicate that in captive chimpanzees, suspensory postures are more frequent in infants than older chimpanzees, which utilize more sitting and lying postures.

This preliminary data from an ongoing longitudinal investigation of the ontogeny of positional behavior in captive chimpanzees suggests that some differences are evident in the locomotor developmental trends of captive and wild chimpanzees. It is possible that these differences reflect changes in the timing of behavioral and physical development between the natural habitat and captivity.

Dental development and canine dimorphism in the common chimpanzee, *Pan troglodytes*. GARY T. SCHWARTZ, Evolutionary Anatomy Unit, University College London, London, UK; DON J. REID, The Dental School, Newcastle upon Tyne, UK; and CHRISTOPHER DEAN, Evolutionary Anatomy Unit, University College London, London, UK.

Many studies have documented aspects of chimpanzee dental development though confusion still exists about both the times of initial mineralization and time it takes to form each anterior tooth crown in chimpanzees. Recent studies of anterior crown formation times in *Pan troglodytes* have concluded that incisors form in less time than those of modern humans and that no clear differences in canine crown/enamel formation times can be distinguished between males and females. The present study combines microanatomical data collected from ground sections in four individuals to investigate incisor crown formation and from 20 *Pan* individuals (10 males and 10 females) to investigate canine crown formation times. In addition, incremental markings in dentine were measured and counted and used to provide an independent assessment of crown and root formation times in *Pan*.

Crown formations times based on counts of short- and long-period incremental lines reveal that, on average, incisors take between 4.49 and 5.65 years to form their crowns suggesting a developmental period similar to that seen in modern humans. In particular, mandibular incisor crowns take between 4.45–5.35 years while maxillary incisor crown formation times range between 4.00–4.45 years. When compared with data on the age at gingival emergence, these data suggest that chimpanzee teeth have a greatly reduced time for root growth before emergence occurs so that early root growth must occur at a faster rate of extension than in modern humans.

Canine crown formation times differ between the sexes and are more variable than previously documented. These new data provide a better comparative yardstick for studies that focus on other living and fossil hominoids.

This work is funded by a grant from the Leverhulme Trust.

Morphology and diversity in fossil hominids: accepting *Homo erectus* and *H. ergaster* as separate taxa is just the beginning. J. H. SCHWARTZ, University of Pittsburgh, Pittsburgh, PA 15260, and I. TATTERSALL, American Museum of Natural History, New York, NY 10024

Although most systematists would agree that there is an important difference between morphological, within-taxon variation and taxic diversity, this distinction tends to remain blurred within paleoanthropology, especially in the consideration of the middle and younger Pleistocene hominids, wherein the species *Homo sapiens* and *H. erectus* remain bastions of the historical legacy of extrapolating perceptions of modern human variation onto the fossil record. Yet even those who might advocate taxonomic restrictiveness within *Homo* can appreciate species diversity among non-human primates. Clearly, if differences exist between extant primates that are taken as distinct genera—e.g. compare the four lorises or the three indrids—then comparable morphological differences among fossils might at least reflect potential species differences. We focus here on the identification of *H. erectus* in the Indonesian and East African hominid fossil record.

An attempt to recognize *Homo erectus* must begin with Dubois' type specimen—in which case it becomes far from clear that all Javanese specimens can be subsumed within the species. Indeed, the features so often cited (e.g. cruciate keeling, "V"-shaped occiput, "bulging" parietals) as

distinctive of this taxon not only are not clearly expressed universally among the southeast Asian specimens, but also do not extend to the East African fossils (sometimes also referred to *H. ergaster*). Among the latter, the better known crania, KNM-ER 3733, ER 3883 and WT 15000, are no less distinct from one another in craniofacial morphology than are extant lorises, and all three fossils differ from the relatively well-preserved Sangiran 17 specimen (e.g. in nasolabial clivus, zygoma, supraorbital-frontal region). ER 3733 also differs in its upper molar morphology from WT 15000, which is clearly distinguishable in its lower premolars and molars from the type specimen of *H. ergaster*, ER 992 (an almost complete mandible with teeth), which, in turn, differs in dental morphology from southeast Asian specimens. That one can delineate various morphs within the East African sample is further indicated by the similar morphologies of ER 3732 with ER 3883 (e.g. in zygomatic flare, supraorbital torus-frontal plane configuration).

JHS was funded by the University of Pittsburgh and IT and JHS by the Ogden Mills and J. B. Tannenbaum Funds, AMNH.

Comparative paleoecology of *Ankarapithecus meteai* and *Sivapithecus parvada*. R. SCOTT<sup>1</sup>, M. ARMOUR-CHELU<sup>2</sup>, R. BERNOR<sup>2</sup>, J. KAPPELMAN<sup>1</sup>, and J. KELLEY<sup>3</sup> <sup>1</sup>Dept. Anthropology, University of Texas, Austin, TX 78712-1086, <sup>2</sup>Dept. of Anatomy, Howard University, Washington D.C. 20059, <sup>3</sup>Dept. Oral Biology, University of Illinois, Chicago, Illinois 60612-7213

The late Miocene has been characterized as a time of global cooling and major changes in faunal diversity. These events are of potential paleoenvironmental significance because they may have established important selective pressures on late Miocene hominoid taxa and served as controls on potential dispersal routes. We present an analysis of the paleoenvironment of two of these late Miocene taxa, *Ankarapithecus meteai* from central Anatolia and *Sivapithecus parvada* from northern Pakistan. Fossil localities preserving the remains of these taxa are dated to 10.4 Ma and 10 Ma respectively.

The types of habitats available to these species may be reconstructed based on the adaptations of other fauna found at these fossil localities. In particular, common taxa are valuable as ecological indicator species. Our analysis includes such ecomorphological analysis of bovids and equids. *A. meteai* is associated with great numbers hipparionine equids. Estimates of equid abundance relative to bovids range from 65% to 45%. In contrast, tragulids followed by bovids are the most numerous ungulates associated with *S. parvada*. Ecomorphological analysis of bovid and equid metapodial morphology was conducted using a comparative sample of extant bovids and both extant and fossil equids. Multivariate, univariate, and descriptive analyses were based on linear measurements, photographic images, and three-dimensional internal and external images rendered using High Resolution X-ray Computed Tomography.

Our analyses indicate 1) a diversity of hipparionine equid sizes and ecomorphs associated with *A. meteai*, 2) that equid ecomorphs associated with *A. meteai* may have exploited habitats without a closed canopy, and 3) that bovid ecomorphs associated with *S. parvada* were probably tied to closed canopy environments. We conclude that *A. meteai* was likely to have inhabited an environment that was more open than that of *S. parvada*. The hipparionine equid radiation and an expansion of more open environments in some regions may be related to late Miocene global cooling and probably contributed to the "mid-Vallesian crisis."

Supported by grants from NSF and the Univ. of Texas

Incongruence between mitochondrial and nuclear DNA estimates of divergence between *Gorilla* subspecies. M.I. SEAMAN<sup>1</sup>, A.S. DEINARD<sup>1</sup>, and K.K.KIDD<sup>2</sup>, <sup>1</sup>Dept. of Anthropology and <sup>2</sup>Dept. of Genetics, Yale University, New Haven, CT 06511.

Genetic divergence between the western lowland gorilla (*Gorilla gorilla gorilla*) and the two eastern subspecies (*G. g. graueri* and *G. g. beringei*) has been previously estimated from mitochondrial DNA (mtDNA) to be at least as large as that between the two species of chimpanzee (*Pan troglodytes* and *P. paniscus*), arguing for the recognition of two species of gorillas (Ruvolo et al., 1994; Garner and Ryder, 1996). We sequenced an additional ~1.2kb of mtDNA (NADH5 gene) in one individual of each gorilla subspecies, and obtained similar estimates. However, we also sequenced over 10kb of noncoding nuclear DNA from eight loci in at least one individual of *G. g. gorilla*, *G. g. graueri*, *P. troglodytes*, and *P. paniscus*, and found a different pattern.

The amount of divergence between eastern and western gorillas as measured from nuclear DNA is substantially less than that between the chimpanzee species. Seven of the eight nuclear loci show a greater divergence between *P. paniscus* and *P. troglodytes* than between *G. g. gorilla* and *G. g. graueri*. Combining all nuclear loci, we observed a total of between 37 and 55 nucleotide differences (or 0.36% to 0.54% nucleotide divergence) between *P. paniscus* and *P. troglodytes*, while only 27-39 nucleotide differences (0.26% to 0.39%) were observed between *G. g. gorilla* and *G. g. graueri*. Although the ranges are large because we observed several haplotypes within a taxon at many of the loci, these two ranges show almost no overlap.

These data argue that the divergence seen in mtDNA is not itself a sufficient reason for recognizing two gorilla species. If genetic data are to be used for determining taxonomic levels, a better understanding of the complex nature of genetic variation in the relevant taxa is required, including the amount and pattern of genetic diversity within as well as between taxa. We feel that the amount of genetic divergence required for two taxa to be considered separate species remains an open question, as does what, if any, taxa should be used as a standard by which other taxa are to be compared.

Association between occlusal form and tooth wear.  
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Many observers have concluded that the edge-to-edge bite is simply a product of heavy wear, that is, rapid occlusal wear allows mesial drift, and leads to an edge-to-edge bite (overbite depth=0, overjet depth=0) (Campbell 1925, Begg 1954). Is this claim universally applicable?

Using 622 cases from the Japanese islands, the association between occlusal form and tooth wear were examined. Specimens were collected from 11 cultural periods and 4 ethnic groups from 6,000 B.P. through the 1970's.

The frequency of overbite accompanied by overjet (overbite depth>0, overjet depth>0) increases to 50% in

the late 8th century and to over 80% after the 14th century, while the degrees of tooth wear decrease throughout time. First, bi-variate plots and correlation coefficients between overbite depth and age groups are performed. No clear correlations between overbite depth and age groups are found. Second, bi-variate plots and correlation for interrelation among stages of tooth wear and age groups are investigated. These tests indicate that degrees of wear increase with aging. Third, bi-variate plots and correlation coefficients between overbite depth and stages of tooth wear are examined. Increase in tooth wear can predict less overbite depth in certain periods, but it is not the same in other periods. Finally, multiple regression analysis is performed in order to find the association between overbite depth and tooth wear. The results show that: 1) less tooth wear on upper incisors predicts overbite depth significantly, however, 2) tooth wear on lower incisors, lower molars, and upper molars, is not significantly associated with overbite depth at all, 3) tooth wear on both lower and upper incisors is significantly associated with overjet depth, but, 4) tooth wear on both lower and upper molars is not significantly associated with overjet depth at all.

In conclusion, tooth wear on maxillary and mandibular molars is not associated with the formation of an edge-to-edge bite and an overbite. The significant association between overbite depth and maxillary incisor wear may be the result of tooth to tooth contact due to an edge-to-edge form of bite.

The nasal fossa of *Rooneyia viejaensis* as revealed by high-resolution X-ray computed tomography. E.R. SEIFFERT, J. KAPPELMAN, and T.M. RYAN, Dept. of Anthropology, University of Texas at Austin, Austin, TX, 78712-1086.

Systematic analyses of early fossil primates continue to suffer from the uncertain polarity of a number of important craniodental differentiae. Despite this problem, some researchers have come to agree that the late Eocene primate *Rooneyia viejaensis* - a taxon traditionally grouped with omomyiform primates - preserves craniofacial features most consistent with a placement near the very base of a radiation that included omomyiforms, eosimiids, tarsiers, and simians. The ambiguous systematic position of *Rooneyia* leaves open the possibility that this taxon could be a basal member of various lineages, and suggests that closer examination of *Rooneyia* could help systematists to further refine both the euprimate and haplorhine craniofacial morphotypes.

In an effort to help resolve the systematic position of *Rooneyia*, the single known specimen of this taxon (TMM 40688-7) was recently investigated using high-resolution X-ray computed tomography in the Department of Geological Sciences at the University of Texas at Austin. These scans have revealed the internal anatomy of the *Rooneyia* cranium in a minute detail previously unavailable for the analysis of small fossil specimens.

This preliminary report considers some important details of the nasal fossa in *Rooneyia*. Turbinals are not preserved in their entirety, but in the posterior nasal fossa the specimen clearly retains a transverse lamina, which presumably enclosed ethmoturbinals II, III, and IV in a rostrocaudally capacious but mediolaterally restricted sphenethmoidal recess. Unlike many other characters used in primate systematics, the polarity of this feature is uncontroversial - it is a primitive character retained from deep in mammalian ancestry, and has only been lost in tarsiers and simians among primates. If this loss is a synapomorphy of a tarsier-simian clade, then *Rooneyia* can not be a basal member of either lineage. Those who choose to retain *Rooneyia* within the taxon Tarsiiformes must explain the loss of the sphenethmoidal recess as yet another craniofacial convergence of tarsiers and simians.



Several aspects of the *Rooneyia* cranium suggest that this taxon was a basal member of the haplorhine stem lineage, but the apparent retention of macrostomatic adaptations in *Rooneyia* clearly calls into question whether or not this taxon was a syncheilic haplorhine. The systematic position of *Rooneyia* remains unresolved, but this finding raises many other important questions bearing on the classification of early fossil primates.

Supported by grants from NSF and the College of Liberal Arts at the University of Texas at Austin.

Differences in adult male-juvenile interactions with regard to relatedness in *Propithecus diadema edwardsi*. R.G. SELTZER, Department of Anthropology, Kent State University, Kent, OH 44240

Previous studies characterizing life histories and behaviors in *Propithecus diadema edwardsi* have shown that adult male investment in juveniles and infants is negligible (Wright, 1995). The intent of this study was to compare adult male-juvenile behaviors in related and unrelated dyads to see if they differed with regard to relatedness.

Two groups of *P. diadema edwardsi* were observed over a three month period in Ranomafana National Park, Madagascar. In one of the groups, the adult male is known to be the father of the juvenile, whereas the adult male and juvenile in the other group were not related. Data were collected on behaviors that reflected the investment of time or resources by the adult males. These variables included grooming time, neighbor distance and, a subset of the latter, feeding distance. Distances were taken during five minute sample intervals.

The average grooming time, in seconds, was larger for the unrelated dyad ( $\bar{x}=40.55 \pm 48.33$ ,  $n=240$ ) than the related dyad ( $\bar{x}=29.21 \pm 26.81$ ,  $n=235$ ). Neighbor distances were farther for the unrelated dyad ( $\bar{x}=1.81 \text{m} \pm 1.96 \text{m}$ ,  $n=782$ ) than the related dyad ( $\bar{x}=1.36 \text{m} \pm 1.58 \text{m}$ ,  $n=390$ ;  $t=4.28$ ,  $p<.05$ ). Likewise, feeding distances were farther for the unrelated pair ( $\bar{x}=3.69 \text{m} \pm 1.27 \text{m}$ ,  $n=362$ ) than the related pair ( $\bar{x}=3.00 \text{m} \pm 1.22 \text{m}$ ,  $n=155$ ;  $t=-2.078$ ,  $p<.01$ ).

Although counterintuitive in the context of "paternal care", the behavior of the unrelated adult male may have provided him with increased mating access to the resident female. At the time of the study, this male was observed to have recently fathered an infant with the resident female. The unrelated male recently immigrated to the group, and such "paternal care" may help establish his residence. The observations of minimal male parental care support Wright (1995), however, their contradiction of conventional paternal care patterns require further investigations. Such studies may help provide support for the link between the observed grooming time and the noted success of mating with the resident female.

Kaposi's Sarcoma-Associated Herpesvirus-Like Sequences Found in Yanomami Indians.

LD SEVERSON<sup>1</sup>, RW LANG<sup>2</sup>, DE CREWS<sup>1,3</sup>, and JE SHAW<sup>2</sup>

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Kaposi's Sarcoma-associated herpesvirus (KSHV), also known as human herpesvirus 8 (HHV8), is a recently discovered member of the herpesvirus family. Segments of the viral genome were first isolated in HIV-related Kaposi's sarcoma (KS) tissues. Subsequent sequencing of the viral genome indicates homology with Herpes saimiri and Epstein-Barr viruses. Over 90% of KS-HIV tissues are positive for KSHV. KSHV has been implicated as an etiologic cofactor in KS pathogenesis. It has not been determined whether KSHV is unique to KS or a ubiquitous infection of humans.

Presence of the virus can be determined by PCR amplification of a 233 bp region of the DNA fragment KS330Bam. We have performed PCR amplification of 69 DNA samples from Yanomami Indians of Brazil. KSHV-like DNA sequences have been detected in six samples. These findings show for the first time that KSHV-like sequences exist in the Yanomami population, suggesting that the new human herpesvirus is widespread in nature and not limited to those with HIV-associated Kaposi's sarcoma.

Effect of settlement and development on child nutritional status: Individual, household and community level factors. B. SHELL-DUNCAN and K. SNYDER, Department of Anthropology, University of Washington, Seattle, WA 98195; WALTER OBIERO, University of Michigan.

A widely held assumption in academic debates and international dryland policy is that settlement of nomadic people will result in improvements in nutrition. Prior studies investigating this claim have contrasted settled vs. nomadic communities, overlooking the enormous variation between different settled communities. Our research among the Rendille of northern Kenya aims to characterize the nutritional status of children from the nomadic sector, as well as 4 settlements that vary widely in terms of ecosystem, market integration, infrastructure and subsistence strategies. Using demographic and anthropometric data collected from 1078 children ages 6 months to 10 years, we test the hypothesis that children in settled communities have overall better nutritional status than nomadic children, and that community level predictors are more important than individual or household level characteristics.

Results from this study reveal that the mean weight-for-height Z-score (WHZ) is .92 SD below the NCHS

reference median, with 15% of children below -2 SD. Comparisons between communities demonstrated that mean WHZ varies significantly between communities, although settlement does not uniformly result in improved nutritional status. Children in the remote lowland community of Korr had the overall lowest nutritional status, while children residing in the District Capitol, Marsabit, had significantly higher WHZ than nomadic children. Additionally, we found that individual level factors (age, sex, and birth order) are significant predictors of WHZ of young children ( $\leq 36$  mo), such that nutritional status declines with age, and is better for boys than girls, particularly first born sons. For older children ( $> 36$  mo) two household factors - female headship and economic status - were significant predictors of WHZ. The addition of location in each model was significant, but improved  $R^2$  by less than 2% in each case. From these results we conclude that 1) settlement can have a significantly negative or positive effect on child nutritional status, and 2) individual and household characteristics are more important explanatory factors than location. Policy implications will be explored.

Is carotid canal a reliable predictor of cranial capacity in great apes and humans? C. SHERWOOD<sup>1,3</sup>, P.J. GANNON<sup>2,3</sup> and R.L. HOLLOWAY<sup>1,3</sup>, Columbia University, New York, NY<sup>1</sup>, The Mount Sinai School of Medicine, New York, NY<sup>2</sup>, NYCEP<sup>3</sup>

The carotid canal (cc) of the temporal bone transmits the internal carotid artery (ica), the main supply of blood to the rostral portion of the brain. Gannon (1990) reported a close correlation ( $r=0.989$ ) between cc area and endocranial volume in catarrhines. This study was designed to test the hypothesis that cc size is a reliable predictor of cranial capacity in living great apes and humans and to determine whether cc can be used to estimate endocranial capacity in fossil hominins.

Dental molding material was injected into the cc of skulls of extant great apes ( $n=61$ ) and humans ( $n=28$ ) to create casts. These casts were sectioned perpendicular to the long axis and the average cross-sectional area of cc was calculated. Endocranial volume was measured with oil seed rape (see Smith *et al.* 1995). The relationship between cc and endocranial capacity was analyzed for left cc, right cc, and total cc.

For the entire sample, total cc area was significantly correlated with endocranial capacity ( $r=0.901$ ,  $p<0.001$ ). Correlation coefficients declined with humans removed from the sample ( $r=0.693$ ,  $p=0.001$ ) and correlations within taxa were low ( $r=0.650$ ,  $p=0.003$  to  $r=0.487$ ,  $p=0.009$ ). Contrary to the findings of Braga and Hublin (1998), the correlation coefficient between cc and cranial capacity was much lower for humans ( $r=0.487$ ,  $p=0.009$ ) than for common chimpanzees ( $r=0.627$ ,  $p<0.001$ ). Mean Prediction Error was calculated to assess prediction model performance. For the entire sample, prediction variables ranged in MPE from 19.7% to 25.3%. MPE's were lower for subgroups of the sample. Total cc was the best predictor of endocranial capacity for great apes (MPE=9.6%) and right cc was the best for humans (MPE=8.6%). ANCOVA was performed on our cc

data using cranial capacity as a covariate to test Braga and Hublin's (1997) claim that humans differ from common chimpanzees in the relative extent of cerebral blood supply. No significant difference between taxa was indicated.

The conclusions of this study are: 1) due to the high MPE for combined great ape and human data, cc is not recommended as a predictor of endocranial capacity for hominins, and 2) humans do not differ from great apes in the supply of blood to the brain via the ica. Our results caution against using correlation coefficient as the sole criterion for selecting prediction variables. The interrelationships of the ica, vertebral artery, and brain size in living hominoids merits further investigation.

Estimation of fetal age. R.J. SHERWOOD, Dept. of Anthropology, U. Wisconsin, Madison, WI 53706, R.S. MEINDL, Dept. of Anthropology, Kent State University, Kent, OH 44242, H.B. ROBINSON, The Toledo Hospital, Toledo, OH 43606, R.L. MAY, Dept. of Biology, Morningside College, Sioux City, IA 51106-1751.

Correct identification of fetal age is important in both clinical and forensic contexts. Clinical estimates are often based on anthropometric measurements (i.e., foot length, crown-rump length). However, ultrasonography now allows for *in utero* measurement of individual long bones and elevates the role of osteometrics in fetal studies.

For the current study, a sample of 522 fetuses ranging from 15 to 43 weeks of gestational age was examined. Requirements for inclusion in the final sample included a detailed pathologist's report and a detailed maternal history. Gestational age for all fetuses was based on accurate reports of mother's last normal menstrual period (LNMP). Multiple births were excluded from the sample.

Principal diagnosis and mechanism of fetal loss were determined from gestational history, dysmorphic evaluation of the fetus, gross anatomical and histological examination of the fetus and the placenta, radiographs, and chromosomal analysis.

One hundred sixty-eight fetuses met the requirements and were included in the final analysis. Of these, 72 were classified as nondysmorphic (i.e., normal growth rates were expected), forming the core group for age estimation. The remaining fetuses were classified by pathological condition.

Fetal age was regressed individually on nine skeletal (measured from radiographs) and four anthropometric measures. Six of the models were adequately described by a linear equation, while the remaining seven required a quadratic term. All showed high correlations with age. Skeletal measures provide the strongest estimators with femur, tibia and ulna identified as the best predictors of gestational age.

**Sagittal growth of the cranial base in second trimester normal and unilateral cleft lip only fetuses.** T.F. SHERWOOD, M.P. MOONEY, T.D. SMITH, J.J. SCIOTE, G.M. COOPER, M.I. SIEGEL, Depts. of Orthodontics and Anthropology, Univ. of Pittsburgh, and School of Physical Therapy, Slippery Rock Univ., Slippery Rock, PA.

Cranial base abnormalities have been shown in individuals with clefts of the lip and/or palate. However, it is unclear whether such abnormalities are primary or secondary to the occurrence of clefting. The present radiographic study was designed to address this question and assess sagittal growth and morphological changes in the cranial base in a second trimester sample of normal human fetuses and a sample of human fetuses with unilateral clefts of the lip only (CLO).

Seventy-seven human fetuses were obtained from the Kraus Fetal Collection, which is housed at the University of Pittsburgh. Sixty-one fetuses had normal craniofacial morphology and ranged between 10 and 22 weeks gestational age. Sixteen had unilateral CLO and ranged between 14 and 20 weeks gestational age. All specimens were positioned in a cephalostat and sagittal radiographs were taken. Various cephalometric landmarks were identified, traced, and digitized for computer analysis. Growth curves of cranial base lengths, angles, and areas were compared between groups using regression analysis and the test of homogeneity of regression line slopes ( $t_r$ ). Cranial base triangles were constructed from the landmarks and differences in cranial base morphology between groups was further assessed using tensor biometric analysis.

In the normal sample, the cranial base angle increased from 118 to 134 degrees between 12 and 14 weeks gestational age and thereafter remained constant. Cranial base angle was positively correlated with length of both the basiocciput ( $p < 0.05$ ) and the anterior cranial base ( $p < 0.05$ ). The anterior cranial base increased in length by 125% over the ages studied while the posterior cranial base increased by 105%. The CLO regression lines showed no significant differences in slopes ( $p > 0.05$ ) for any linear, angular, or area measures compared to normal regression line slopes. Tensor analysis also revealed no significant differences in cranial base morphology between the groups.

Results from the present study suggest that the sagittal cranial base growth abnormalities and dysmorphology noted postnatally in individuals with CLO are secondary, compensatory growth abnormalities and are probably not primary, etiopathogenic factors in facial clefting.

Chimpanzees as an outgroup for the examination of human phylogeny. E.D. SHIELDS, Faculty of Dentistry, McGill University, Montreal, Quebec, Canada H3A 2B2

In the assessment of human origins, chimpanzees represent the best hominoid outgroup for comparisons. Such an outgroup roots the modern human population cluster, or continuum. Nearly five million years ago Chimpanzees and hominids evolved from a common ancestor and yet chimpanzees and modern humans share ~99% of their DNA in common. This study incorporates chimpanzees into a worldwide modern human database of quantified complete tooth variables (~30 per tooth; e.g., root, pulp, enamel) in an attempt to develop a more accurate phylogeny of the hominoid continuum, with only intervening extinct hominids missing.

Canonical discriminate function analysis was performed among mainly Liberian chimpanzees (28 ♂/26 ♀; 329/314 teeth) and a broad spectrum of global human populations:

Southeast Asians (31 ♂/29 ♀; 326/369 teeth); Mongolians (58 ♂/61 ♀; 525/521); pre-Inca (Huari Empire) (27 ♂/22 ♀; 309/209); Western Africans (41 ♂/30 ♀; 515/389); Bantu (53 ♂/45 ♀; 476/434); Western Europeans (65 ♂/82 ♀; 450/635); and Australian aborigines (38 ♂/17 ♀; 185/143); total humans: (313 ♂/286 ♀; 2,786/2,700 teeth). The major eigenvector explained 77% of the total variance and showed a tight cluster of humans, with chimpanzees as a distant outgroup. Within the human community first sub-Saharan Africans and then, close in, Australian aborigines were positioned towards chimps. Their relative orientation suggested an African human origin with Australian aborigines forming the early first branch leading to the dispersion of Eurasians. The total tooth data speaks against the multi-regional evolution of modern humans. Thin enamel and big teeth with relatively large roots characterized chimp non-molar teeth. Interestingly, chimp molars were not larger than human molars. Humans showed a generalized sexual dimorphism for all teeth with males having bigger teeth, bigger relative roots and thinner enamel, while only chimp canines had significant and impressive sexual dimorphism. The suggested evolutionary significance of the observed total tooth variation will be discussed.

Individual and Population Level Admixture Estimates for Geographically Defined African-American Populations. M. D. SHRIVER, A. MARCINI, and E. J. PARRA, Department of Human Genetics, Allegheny University of the Health Sciences, Pittsburgh, PA 15212.

Little is known regarding the dynamics and proportions of human admixture levels, largely because of a dearth of informative markers. We have been working to identify DNA markers that have large differentials in allele frequency, which we call population-specific alleles (PSAs). Presently, we have a panel of nine African/European PSAs which we have used to study the admixture proportions of ten African-American populations living in different parts of North America [Maywood (IL), Detroit, New York, Philadelphia, Pittsburgh, Baltimore, Charleston, New Orleans, Houston, and Jamaica]. European genetic ancestry ranges from 6.8% (Jamaica) to 22.5% (New Orleans). We discuss these data in the context of the history of African-American populations and previous studies of admixture in these groups. Additionally, we have computed individual admixture levels for the persons sampled. Although it is clear that more markers will be needed, there is evidence for differences among populations in the distributions of individual admixture. We have also estimated the male and female European contribution to African Americans on the basis of mtDNA and Y-chromosomal PSAs. The results indicate sex-biased gene flow from Europeans in the formation of African-American populations, the male contribution being substantially greater than the female contribution. Analysis of diagnostic sites for the Amerindian-specific mtDNA haplogroups (A, B, C, and D) shows no evidence of a significant maternal contribution to any of the ten African-American populations included in this analysis.

We have detected significant non-random association between two markers located 22 cM apart (FY-null and AT3). This association is most likely due to admixture linkage disequilibrium created in the process of hybridization of the two parental populations, Africans and Europeans. The strength of this association and the substantial genetic distance between FY and AT3 emphasize the importance of admixed populations as a useful resource for mapping genes for diseases showing prevalence differences between parental populations.

Evidence of demographic crises in 18th century in urban community (Martigues, France). M. SIGNOLI, S.BELLO, Gy. PALFI and O. DUTOUR, Dpt of Biological Anthropology, UMR 6578 CNRS-University of La Méditerranée, Faculty of Medicine, F-13885 Marseille Cedex 5.

Numerous demographic crises affected human populations in the past. These crises had important consequences on the history and evolution of human settlement. One of them is the selection of genetic traits in the surviving group. Therefore, the genetic characteristics of present populations can result from past demographic crises. In order to evaluate the frequency, the intensity and the pattern of demographic crises on a middle-sized urban community, we selected the city of Martigues (Provence, France) because of its well documented 18th century historical records. We choose the period 1702-1752 (50 yrs) which included at least two historically known major crises : famine (1709-1710) and plague (1720-1721) to study demographic parameters of the population (5566 people). The study was performed on the basis of the 1702 census and the parish registers (1702-1752 : baptisms, weddings, funerals).

Demographic crisis was identified by the doubling of annual mortality associated with a one third decrease of birth rate (Goubert 1960), its intensity was scored using the scales of Hollingworth (1975) and Dupâquier (1979). Our results evidenced 3 crises in this period :

- (i) a strong one in 1705, characterized by mortality increase of 67%, which mainly concerned the 0-9 yrs age cohort (76% of death), specially the 0-4 yrs,
- (ii) a major crisis in 1709-1710 (+347%) concerning the 10-29 yrs and over 40 yrs age categories,
- (iii) a major crisis in 1720-1721 (+499%) which concerned the 10-59 age group.

We interpreted the first crisis, which was unknown, as an acute infantile infectious disease : it reduced the population size of 4%, without any serious consequences. The second one, attributed to starvation, spared the young adults and mimic the profile of natural mortality, it killed 26% of the population which recovered its initial size in 10 years. The third one corresponding to the plague epidemic presented a specific pattern which surprisingly mimic the age distribution of the living population, it suddenly reduced the population size of 36% with a long period of recovery.

These results showed the frequency of demographic crises in the past and the variability of their impacts, both in quantitative (intensity) and qualitative (selection) aspects. They enhance the specificity of plague impact (preservation of the population structure). In term of natural selection, the effect of these crises on the recent human evolution remains to be defined.

The Diet of Worms: An analysis of mole microwear and its relevance to dietary inference in primates and other mammals

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An important factor in ensuring the usefulness of dental microwear as a technique for the elucidation of the diets of fossil animals is the analysis of a range of modern forms that includes a wide assortment of different dietary regimes. Although the majority of microwear work has focussed on primates and their kin, primate diets tend to be highly variable, so that the microwear signal that they give is complicated to interpret. For this reason it is important to look at microwear patterns in non-primate groups, to allow all possibilities to be considered in the interpretation of patterns observed for fossil taxa. This study looked at microwear on lower first and second molar shearing facets of two modern species of the family Talpidae (*Scapanus orarius* and *Parascalops breweri*). These forms were compared with a wide array of modern small mammals (primates, bats, and other insectivores), which include a variety of types of omnivores as well as species that eat only invertebrates. In comparison with the microwear seen on the homologous shearing facets of these other forms, talpids have a highly distinctive microwear pattern composed of numerous, short, and very narrow scratches. The talpid diet includes a high proportion of earthworms, and ingestion of these annelids involves incidental consumption (and inevitable dental processing) of a considerable amount of soil. It is hypothesized that this microwear pattern is caused by these gritty particles. Since no primates routinely include large amounts of dirt-covered food in their diet, this pattern may aid in the interpretation of enigmatic patterns in fossil specimens. These observations are of particular relevance to hypotheses that suggest a role for dirt-covered food in forming the microwear patterns seen in hominid species.

This work was supported by NSF grant SBR-9601766.

**Bioanthropological aspects of ecologically diverse Amazonian peasant populations.** H.P. Silva, Department of Anthropology, The Ohio State University, Columbus, OH 43210, USA.

Few studies have focused on the relationship between environmental and health changes on peasant populations of the Brazilian Amazon. This paper presents data on three rural groups undergoing intense ecological and life style changes in the State of Pará, Brazil. The populations studied live in different ecosystems and practice diverse subsistence activities. Caxiuanã (N=252), a more traditional group, live in an isolated black water ecosystem, and practice subsistence fishing and extraction of natural products from



the forest. The two other populations live in Ituqui island and exploit a white water, floodplain ecosystem. Santana (N=412), is a village with intense contact with local markets. Aracampina's inhabitants (N=380) are more dependent on subsistence agriculture and fishing, for both consumption and commerce. Ituqui groups represent a more westernized life style since both actively participate in the local economy.

Anthropometric measurements, clinical exams, epidemiologic and nutritional surveys were conducted in the rainy and dry seasons. Overall, the group with a more traditional life style presents lower blood pressure, and fewer nutritional deficiencies than the more westernized groups. In all groups children are short and light for their age, averaging between the 25th and the 50th percentile of international standards. Nevertheless, their BMI is appropriate for their age. In Santana the most frequent diseases are anemia (82%), cavities (80%), and skin infections (65%). These percentages are significantly higher than those observed in Caxiuanã. In the island populations, the incidence of acute respiratory infections reaches 90% during the rainy season. In all groups more than 70% of the individuals are infected with intestinal parasites. In Santana and Aracampina the pooled average number of children per couple is 6.1, compared to 5.1 in Caxiuanã.

Since the environment and subsistence base of these groups are changing drastically, this investigation provides unique information about biological adaptations among populations experiencing shift from traditional to more westernized life styles.

Assessing the taxonomic significance of mandibular variation in *Paranthropus boisei*. N.J. SILVERMAN, B.G. RICHMOND, and B.A. WOOD, Anthropology, George Washington University, Washington, DC 20052.

Although it is generally agreed that the craniodental fossils assigned to *Paranthropus (Australopithecus) boisei* sample a single taxon, it has been suggested that the substantial size variation in *P. boisei* may not be attributable to sexual dimorphism, or to other causes of intraspecific variation. The large number of mandibular remains attributed to *P. boisei* provides the opportunity to compare variation in that sample with the variation observed in great apes and humans. This study examines mandibular morphological variation and assesses the probability that the degree of variability observed in the fossil sample is present in extant samples.

Twenty-three measurements were taken on the corpus of 195 adult human and ape mandibles (*Homo sapiens*: N=52; *Pan troglodytes* and *schweinfurthii*: N=24; *Gorilla gorilla gorilla* and *beringei*: N=56; *Pongo pygmaeus pygmaeus* and *abellii*: N=63), and 30 adult fossil hominid mandibles, of varying degrees of preservation, attributed to *P. boisei*. Canonical Variates Analysis (CVA) was employed to compare the mandibular morphology of the more complete fossils (n=6) with that of the extant taxa. The Coefficient of Variation (CV) of corpus height and breadth at M1 was computed for a sample of 28 mandibles attributed to *P. boisei*, and compared to 1,000 randomly-sampled CVs for

each extant taxon. The likelihood of finding a difference as great as that seen in the fossil sample was noted.

Great ape and modern human mandibles can be distinguished on the basis of corpus morphology alone, with symphyseal depth and corpus height being the most influential discriminating variables. The mandibles of *P. boisei* are characterized by an unusually thick corpus, arguably an adaptation to resist torsion.

The CV of *P. boisei* corpus area is never observed in the human and chimpanzee samples, rarely in gorillas ( $p < .05$ ), but is not uncommon in orangutans ( $p < .25$ ). These results are consistent with the interpretation that the *P. boisei* hypodigm represents one strongly dimorphic species.

Supported by The Henry Luce Foundation.

Are Morphological Phase Indicators of Age Estimation Universal?: Revising the standards for a Bosnian forensic population. T. SIMMONS, Anthropology, Western Michigan University, Kalamazoo, MI 49008 and V. TUCO, R. KEŠETOVIĆ, and Z. CIHLARZ, Institute of Forensic Medicine, Tuzla Clinical Center, Tuzla, Bosnia-Herzegovina.

This research addresses the presumption of the universality of "age-at stage" morphological indicators and the need for population-specific standards. During the identification process for victims of the Balkan War recovered from mass graves, consistent discrepancies between the actual age of the identified individuals and the morphologically estimated ages (from the clavicle, rib, and pubic symphysis) were noted.

This study is based on an autopsy-derived sample of approximately 300 Bosnian individuals of known age and sex. The individuals ranged in age from 11 to 82 years. The medial clavicle was evaluated using the Webb-Suchey (1985) phase system; the right fourth rib was appraised using the Iscan-Loth (Iscan, et al. 1984a, 1984b, 1985) phase system; and the pubic symphysis was assessed using the Suchey-Brooks (Brooks and Suchey 1990) phase system. Each skeletal indicator was evaluated independently, and the age of the individual was unknown to the examiner at the time of the assessment.

The Bosnian sample deviates significantly from the U.S. samples in the above studies. This is most apparent in the mean ages for the pubic symphysis phases; in particular, for phases 5 and 6 the mean ages for the Bosnian population are nearly a decade older than those for the U.S. population exhibiting the same phase. Similar disparities between U.S. and Bosnian populations are evident for the medial clavicle and sternal rib.

This study also employs Probit analysis to provide the most effective means of age estimation for these methods where sequential morphological phases are assessed.